THE POLLEN MORPHOLOGY OF DALEA SECTION CYLIPOGON[1] (PSORALEAE: LEGUMINOSAE)

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ABSTRACT—Pollen grains of *Dalea* section *Cylipogon* are described by scanning electron microscopy. This section consists of ten species; nine are discussed here. In this section there are three definite pollen types. Two types are clearly distinct while the third is intermediate. The first type is spherical, highly reticulate with anomotreme apertures. The second is prolate, finely reticulate with tricolpate apertures. The intermediate type has three different forms, two prolate and a subprolate form.

The genus *Dalea* is a heterogeneous group which is presently being revised by R. C. Barneby. An investigation of the pollen morphology of *Cylipogon* was initiated for two reasons; first, to support the segregation of these species into a section and second, to clarify the species boundaries of these taxa, if possible.

The proposed section *Cylipogon* is composed of ten species with similar morphological characteristics. The pollen of the following *Dalea* species have been examined:

D. aurea Nutt.
D. jamesii T. & G.
D. luisana S. Wats.
D. wrightii Gray
D. hallii Gray
D. laniceps Barneby
D. nana Torr.
D. parrasana Brandg.
D. prostrata Ort.

The tenth undescribed species is known only by the fruiting form. Voucher specimens are listed in Table I.

MATERIALS AND METHODS

Pollen grains were prepared by a modification of the standard acetolysis method devised by Erdtman (1952, 1960). The pollen material was not centrifuged but was allowed to settle out of the medium. This technique greatly increased the quantity and quality of the pollen yield. Pollen prepared for scanning electron microscopy was washed in 75% ETOH until all visible traces of the acetolysis solution were gone.

[1] A description of *Dalea* section *Cylipogon* will be published in a revision of genus *Dalea* by R. C. Barneby, currently in manuscript (Mem. N. Y. Bot. Gard. vol. 27).

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The washed pollen was deposited on the nonadhesive side of metallic tape, attached to aluminum stubs and allowed to air dry. The desiccated pollen was then coated with gold-palladium and examined with a MSM-2 Mini-SEM and AMR-1000.

RESULTS

The pollen morphology of *Cylipogon* is of three types. *D. aurea* and *D. nana* characterize the first pollen type. These species possess very similar but not identical pollen grains. The pollen of both species is highly reticulate with spherical structures underlying and connecting the reticulations. The grains of both species are spherical with anomotreme apertures. The specific aperture patterns of the pollen grains can be used to distinguish these species. *D. aurea* is characterized by at least two forked apertures whereas *D. nana* has only one forked aperture and a donut-shaped aperture. (Figs. 1, 2 and 5)

The second pollen type is represented by *D. halli*, *D. jamesii*, *D. laniceps*, *D. prostrata*, *D. parrasana* and *D. wrightii*. The pollen grains of these species are almost identical. They cannot be separated morphologically by shape, by reticulation or by aperture type, position and number. Polar lengths may be helpful but these measurements are not available. The pollen of this group is prolate, tricolpate with a finely reticulate sexine. (Figs. 3 & 5)

D. luisana characterizes the third pollen type. The pollen of this species is predominately prolate but some grains are subprolate. All mature grains have a reticulated sexine similar to the second pollen type. Three distinct aperture arrangements have been found. One of the patterns is a tricolpate grain similar to pollen group two. (Figs. 4 & 5) The second aperture arrangement is formed by three colpate apertures merging at a single equatorial point producing a forked effect. The third form seems to be a distortion of the previous arrangement. Three undulating apertures merge at the approximate pole of the subprolate grain rather than at the equator. The apertures appear similar to those of *D. aurea* and *D. nana* because of the undulations and the forked junction.

DISCUSSION

The pollen morphology of the section *Cylipogon* shows a continuum of pollen types from a prolate, tricolpate grain (*D. hallii*) to a spherical anomotreme grain (*D. aurea*). *D. luisana* appears to be the intermediate pollen type because of its variability and aperture distortion. Certain pollen grains of *D. luisana* are prolate tricolpate while others are distorted to subprolate anomotreme grains. *D. luisana* pollen grains represent the intermediate forms connecting the two extremes. Thus, section *Cylipogon* seems to be a natural taxon.

Three of the nine species examined can be conclusively identified on the bases of their pollen morphology. They are separated in the following manner:

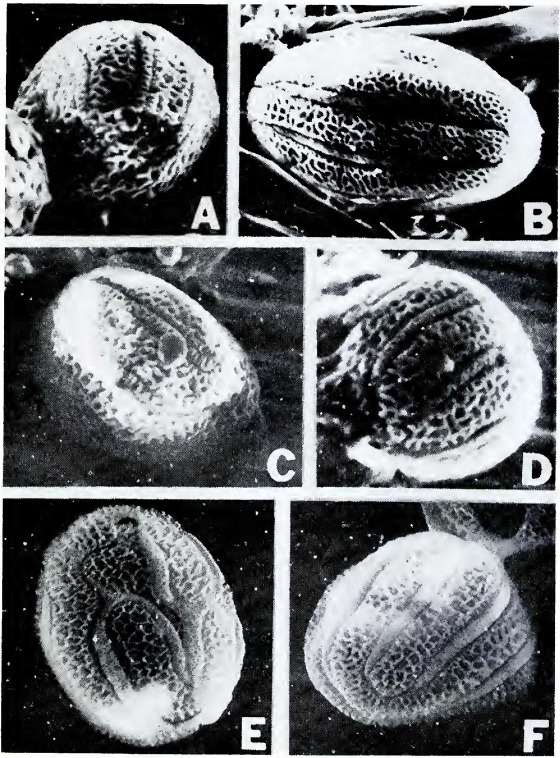

Fig. 1. *Dalea aurea*. A. 1000x, B. Note that the grain has collapsed slightly, 1250x, C. 1000x, D. 1125x, E. Note two forked apertures, 1425x, F. 1500x, Note that A. & C. are the same grain from the rear and front.

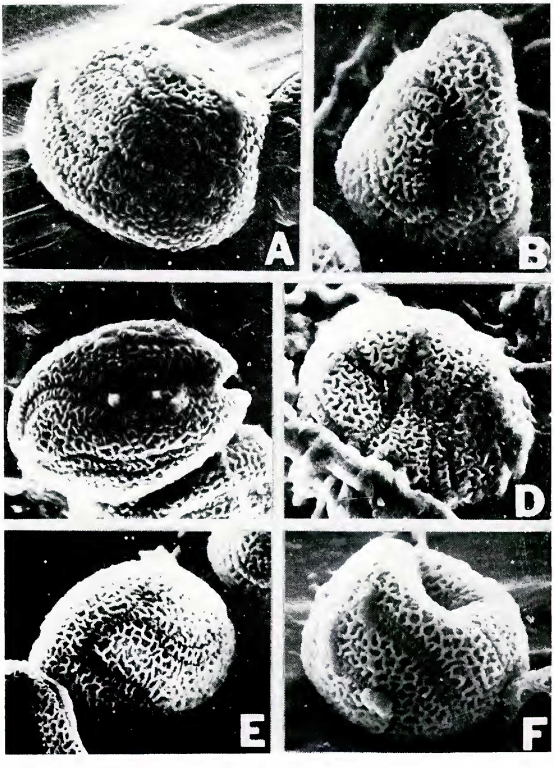

Fig. 2. *Dalea nana*. A. 1375x, B. Note donut-shaped aperture, 1875x, C. 1125x, D. Note forked aperture, 1250x, E. Note forked aperture, 1375x, F. 1500x.

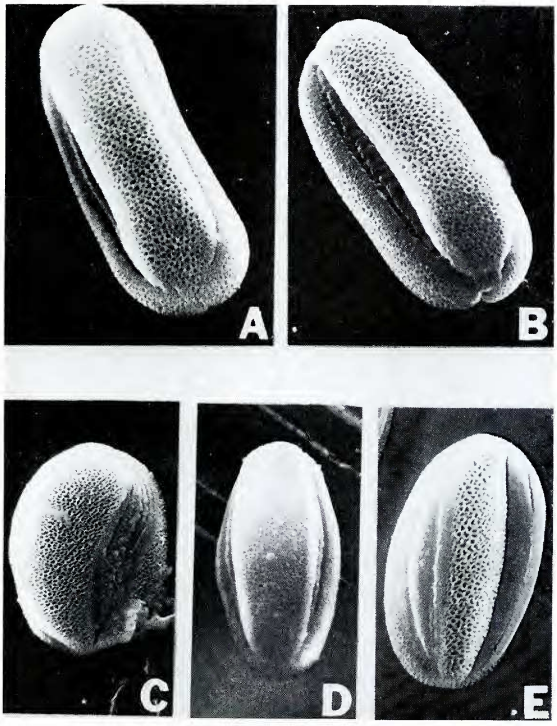

Fig. 3. Pollen of group two. Note shape and tricolpate condition.
A. *Dalea jamesii*, 2438x, B. *D. Hallii*, 2250x, C. *D. lanceps*, 1425x, D. *D. prostrata*, 1625x, E. *D. wrightii*, 1625x.

1. Spherical; sexine highly reticulate; spherical protrusions between the reticulations.
   2. Two forked apertures present; donut-shaped aperture absent . . . . . *D. aurea.*
   2. One forked aperture; one donut-shaped aperture present . *D. nana.*
1. Prolate to subprolate; sexine finely reticulate; spherical sexine protrusion absent.
   3. Grains tricolpate . . . . . *D. hallii, D. jamesii, D. laniceps, D. prostrata, D. parrasana, D. wrightii.*
   3. Grains with three merging colpate apertures and grains with tricolpate apertures . . . . . *D. luisana.*

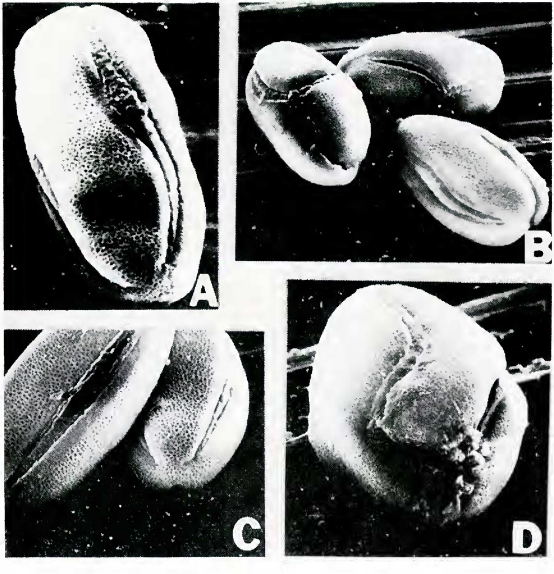

Fig. 4. *Dalea luisana.* A. Note tricolpate apertures, 2000x. B. Note colpi merging at the equator, 1125x, C. Note the number of furrows and the aperture, 1688x, D. Note undulating colpi merging and the shape of the grain, 1875x.

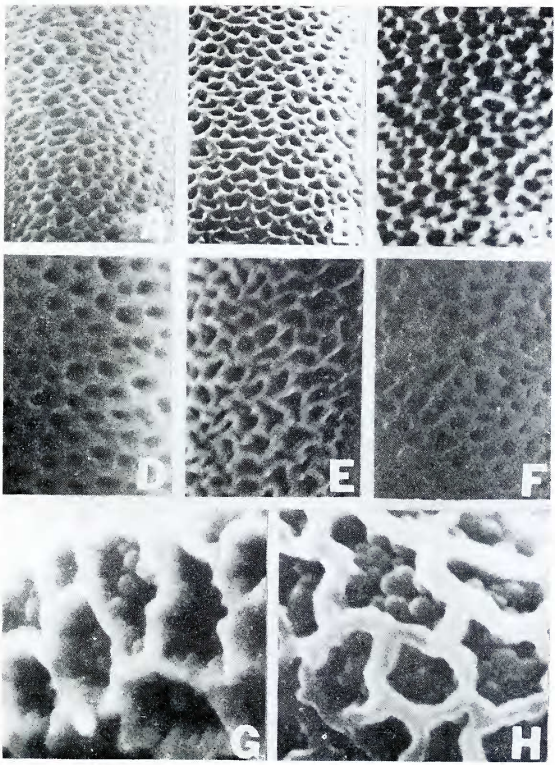

Fig. 5. Reticulation in section *Cylipogon*. A. *Dalea hallii*, 6125x, B. *D. jamesii*, 6125x, C. *D. laniceps*, 6500x, D. *D. prostrata*, 11875x, E. *D. wrightii*, 6875x, F. *D. luisana*, 11800x, G. *D. aurea*, Note spherical protrusions between ridges, 12500x, H. *D. nana*, Note spherical protrusions between ridges, 10625x.

Table I. Voucher Specimens for *Dalea* section *Cylipogon*

Taxa	Collector	Location	Herbarium
D. aurea Nutt.	C.L. York, 54389	Bell Co., Texas	SMU
	M.J. Trlica & D.V. Sellers, 115	Carson Co., Texas	NY
	S. Hewitt, 23	Comanche Co., Texas	SMU
	D.S. & H.B. Correll, 12995	Cooke Co., Texas	SMU
D. hallii Gray	B.L. Turner, 1845	Dallas Co., Texas	SMU
D. jamesii T. & G.	J. & C. Taylor, 3715	Cimarron Co., Oklahoma	SMU
D. laniceps Barneby	Ripley & Barneby, 14962	Coahuila, Mexico	NY
D. luisana S. Wats.	Ripley & Barneby, 14768	San Luis Potosi, Mexico	NY
D. nana Torr.	F.R. Waller, 1412	Deaf Smith Co., Texas	SMU
	J.W. Thieret, 30891a	Brewster Co., Texas	SMU
	L.H. Shinners, 32284	Menard Co., Texas	SMU
D. parrasana Brandg.	Ripley & Barneby, 13282	Coahuila, Mexico	NY
D. prostrata Ort.	Ripley & Barneby, 13940	Chihuahua, Mexico	NY
D. wrightii Gray	SMU-DMNH, 102	Brewster Co., Texas	SMU

Absolute measurements of the major axis of the prolate, tricolpate grains may provide information which can be used to separate these taxa.

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